gross specimens. Contributions to the subject have not yet resulted, according to the author, in discovering the ideal method of preparation; but to one who has himself experimented along this line, this will not appear as any unpardonable failure. A number of experiments have been made, and as a result, a new fluid is recommended. Its composition is water and alcohol, each 400 c.c.; glycerine, 250 c.c.; zinc chloride and sodium chloride, 20 gm. each. The specimen, after having its ventricles, and, if possible, its blood vessels, injected with this fluid, is immersed in it for three days, and subsequently in a mixture of equal parts of the fluid and seventy per cent. alcohol for a week or more, when it is finally preserved in ninety per cent. alcohol. Further experiments are under way, which we may hope to hear from later.

The Effect of Stimulation and of Changes in Temperature upon the Irritability and Conductivity of Nerve Fibers. W. H. HOWELL, S. P. BUDGETT AND ED. LEONARD. Journal of Physiology, Vol. XVI., pp. 298-319. London, 1894.

The purpose of this research, somewhat different from similar studies in this field in which attention has centred about irritability of nerve fibers at different temperatures, is to discover the relations of temperature to conductivity, with the hope of throwing some light on the nature of the nerve impulse. By the use of both medullated and non-medullated nerves, it was hoped to learn something also in regard to the function of the medullary sheath.

The method consisted in cutting the nerve and laying it in a small brass tube, around which water of any desired temperature was made to circulate. Experiments were made on both frogs and mammals, rabbit, dog and cat. It has been known for some time that nerves may be warmed or cooled within certain limits to a point where they lose their irritability and conductivity, and that, on bringing them back to a temperature between these limits, they may regain both these properties. The principal additions to our knowledge contributed by the present investigation, refer to the order in which conductivity is arrested by cooling in different classes of nerve fibers, and to something unique in nerve-fiber-physiology, viz., a rapid fatigue of certain fibers at the point of stimulation, hence called by the authors, "stimulation fatigue." Since this is a point by itself, it may be considered first. "Stimulation fatigue" was discovered in connection with stimulation of the sciatic nerve of the cat for the study of the effects of cooling on motor fibers, vaso-constrictor fibers, and secretory fibers to the sweat glands of the paw. In every case, whether cold was applied or not, stimulation ceased to have any effect on the constrictor and secretory fibers, and it looked as though a genuine nerve-fiber-fatigue effect had been demonstrated. Later, it was found that this fatigue existed only at the point of stimulation, and that if the electrodes were shifted a mm. down the nerve, no similar fatigue of motor fibers was present, and since these are medullated and the vascular and secretory are non-medullated, it seemed to point to functional difference due to the medullary sheath. To test this point, stimulation was applied to the rami between the spinal cord and sympathetic ganglia, where both secretory and vaso-constrictor nerves are supposed to possess medullary sheaths. Here the results crossed, the vaso-constrictor fibers being not subject to stimulation fatigue, as predicted, while the secretory fibers were fatigued as before. This breaks down the interesting generalization and leads to the conclusion that the phenomenon of stimula-

tion fatigue must be due to differences in the conducting portion of the fibers, rather than in any difference in their sheaths.

Several other points of interest may be abbreviated from the conclusions as follows: 1. Cooling may be conveniently used to block the nerve impulse where it is desirable to suspend conductivity without injury to the nerve. 2. The temperature at which conductivity is suspended varies somewhat in different fibers, lying between 5 and 0 C. The cardiac inhibitory fibers of the rabbit offer an exception to both of the above rules in not regaining conductivity well and in losing it at 15 C. 3. "A nerve impulse in passing into a stretch of fiber of different temperature may suffer an increase or a diminution in force, according as the temperature of this portion of the nerve is above or below that in which the impulse originated." The force of the impulse is increased by heat and diminished by cold. 4. The method of cooling may be used to differentiate the physiological varieties of nerve fibers combined in a common trunk, viz., to separate vaso-constrictors from vaso-dilators in the same trunk, inhibitory and augmentory fibers in the vagus, etc.

A Microscopical Study of Changes Due to Functional Activity in Nerve Cells. C. F. HODGE. Journal of Morphology. Vol. VII. pp. 95-168. Plates VII. and VIII. 1892.

The earlier experiments in this research were first reported in this JOURNAL for 1888, '89 and '91, and dealt respectively with the changes produced in spinal ganglion cells by electrical stimulation and with the process of recovery from fatigue thus produced. It is unnecessary to recapitulate the results of these experiments further than to remind the reader that the nucleus became smaller, irregular in outline and stained darker as stimulation was continued, and the cell protoplasm became more or less vacuolated according to the degree of fatigue induced.

The point in which the present paper forms an advance is in a study by similar methods of effects in the nerve cells of normal daily activity, and it is intended in this review to cover this last section of the work.

The experiments were made by taking the animals, English sparrow, pigeon, swallow and honey bee, at the beginning and end of their day's work. The above animals were chosen because of their constant and well defined rhythm of diurnal activity. Similar preparations of the cerebrum, cerebellum and spinal ganglia were compared in six pairs, morning and night, of birds, and the cerebral ganglia of ten couples of bees each morning and night. The result, which is of greatest interest to psychologists, is that a greater degree of fatigue-change is often produced by ordinary daily work than can be obtained by electrical stimulation. Sets of cells were measured as in the former experiments, and the nuclei were found in all cases smaller in the evening specimens. This difference in the spinal ganglion cells of the birds amounted to from thirty-three to sixty-four per cent., showing an average for the birds of forty-eight and two-tenths per cent. The nuclei of the cells of the occipital cortex showed a slightly greater difference, thirty-six to sixty-nine and seven-tenths per cent., with an average loss of fifty-one and five-tenths per cent. In the honey bee experiments, the nuclei of the antennary lobes were measured and showed a shrinkage in volume of from nine to seventy-five per cent. The spinal ganglia of two foxes were also examined and only a moderate degree of change was demonstrated. As the carcasses after skinning could not be identified, the amount of fatigue, or the length of